CAWa Regional Research Network
Central Asian Water

Federal Foreign Office

Water and climate-related research in the CAWa Project

Abror Gafurov

CAWa Project coordination

GFZ German Research Centre for Geosciences

Section Hydrology

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www.cawa-project.net

Funding

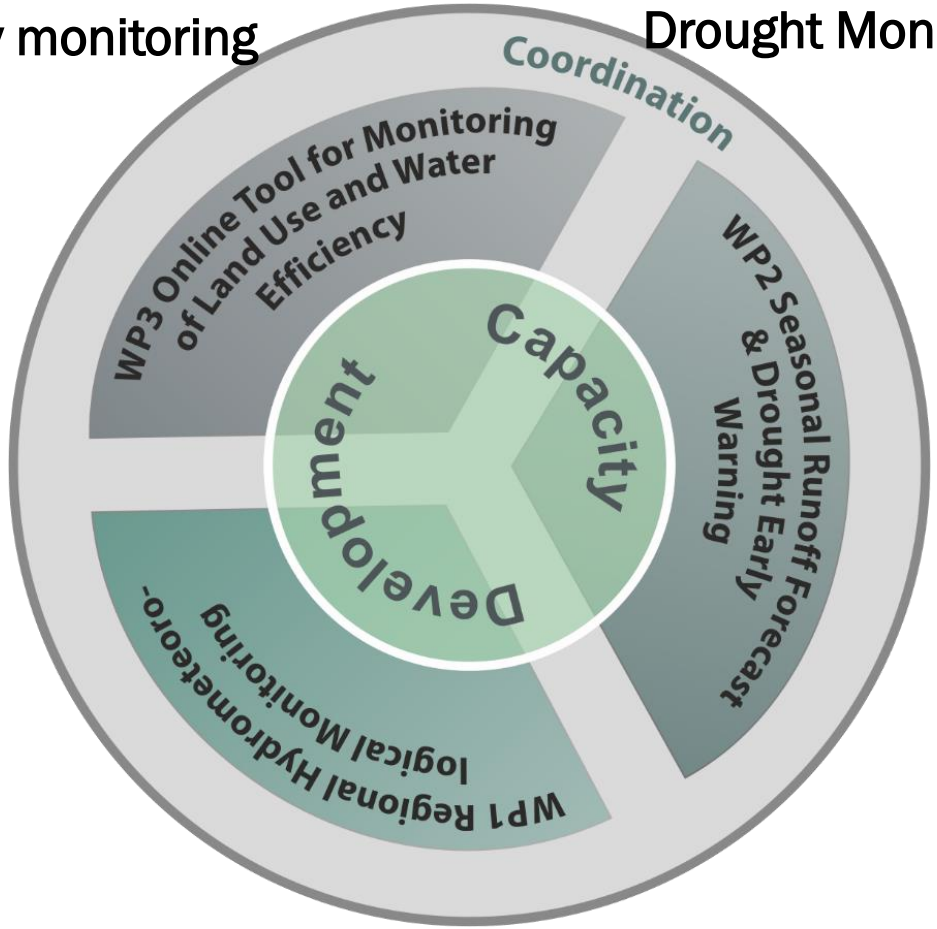
- Funded by the German Federal Foreign Office
- Project phases 2008-2011, 2012-2014, 2015-2017
- Phasing out 2018-2019
- Part of the German Water Initiative for Central Asia – the so-called „Berlin Process“
  - GIZ programme TWMP
  - Research project CAWa
  - Master Programme „Integrated Water Resources Management“ at German-Kazakh University

The German Foreign Minister Steinmeier opening the „Water Unites“ Conference in Berlin in April 2008.

Topics and Partners

WP 3: Space-based land and water use efficiency monitoring

WP 2: Seasonal Runoff Forecast and Drought Monitoring



WP 1: Ground-based and space-based monitoring of water resources

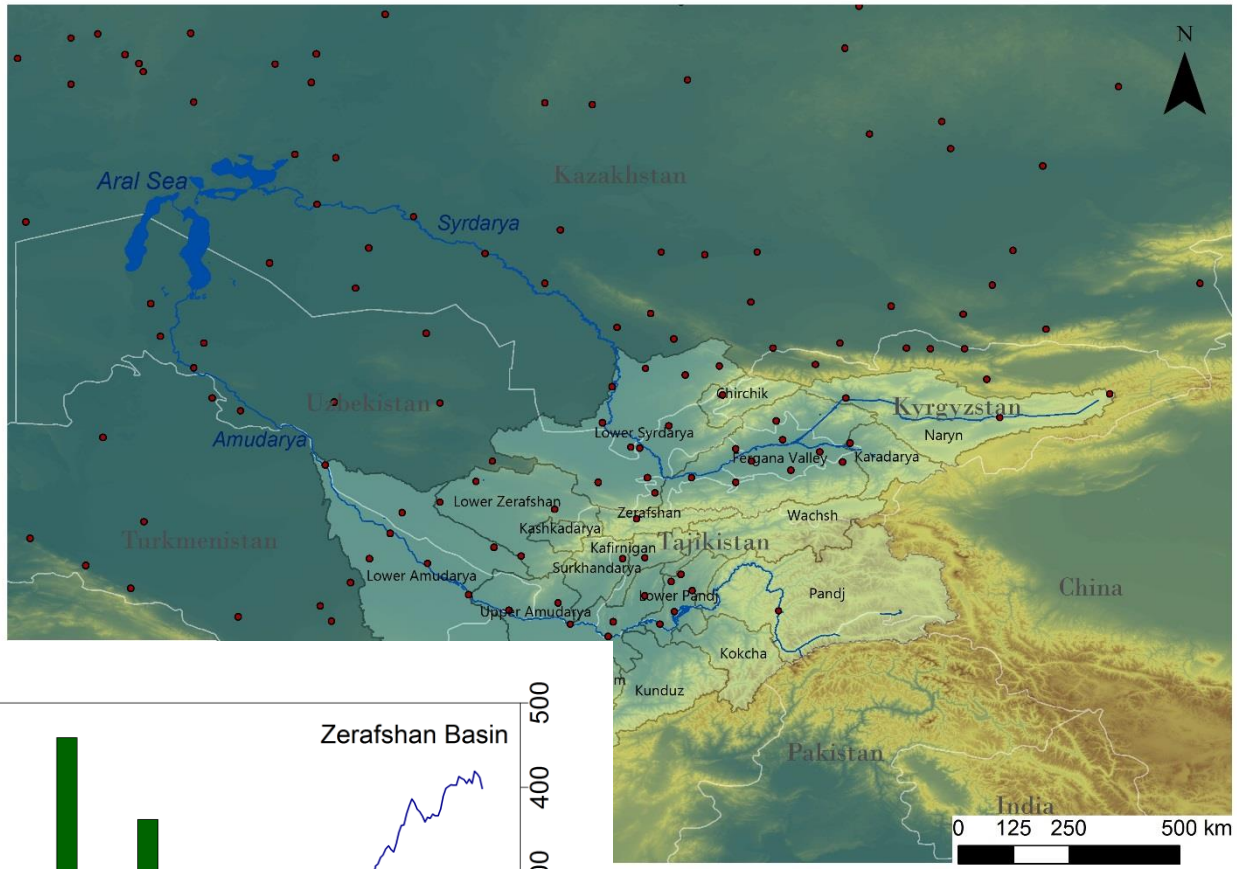
REGIONAL HYDROMETEOROLOGICAL MONITORING

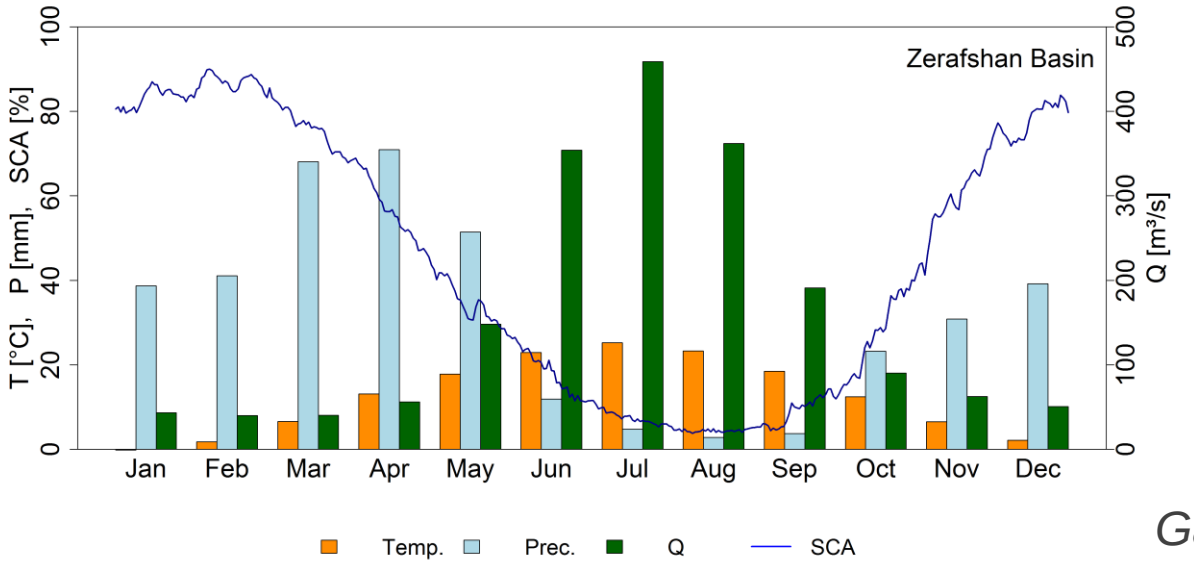
GFZ Helmholtz Centre Potsdam

CAIAG

REGIONAL HYDROMETEOROLOGICAL MONITORING

- Limited observations at high altitudes
- Water resources are stored at high altitudes



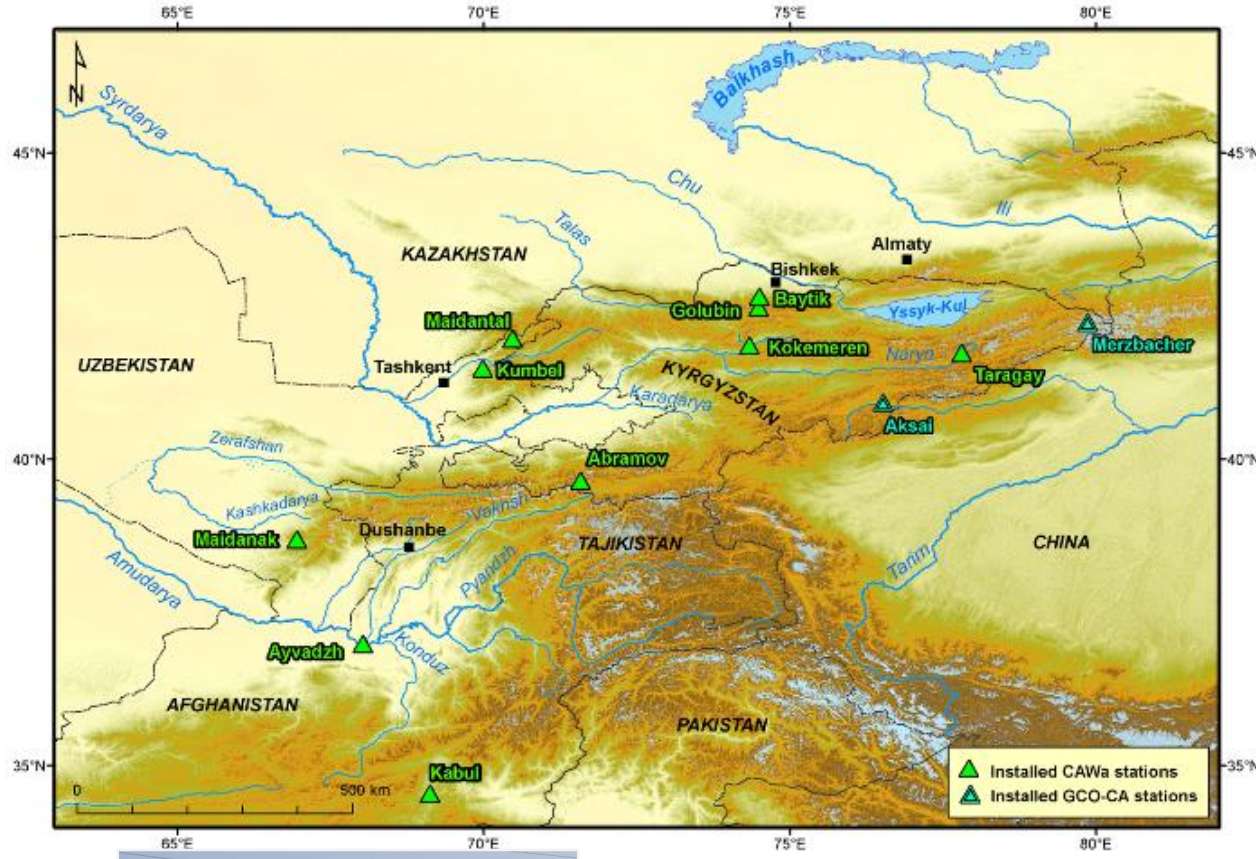


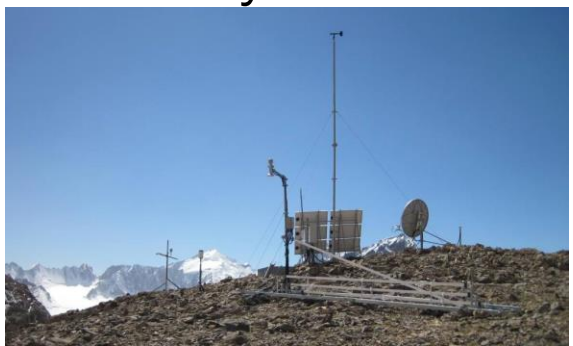
Gafurov et al., 2015, TC

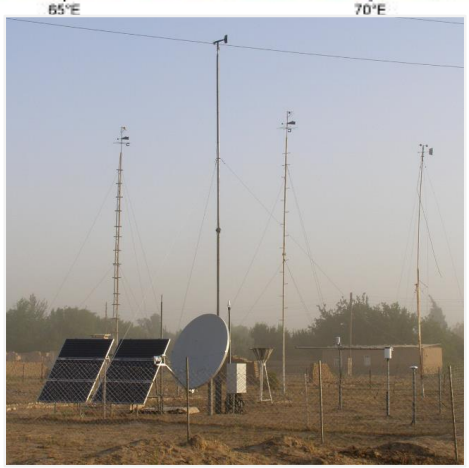
REGIONAL HYDROMETEOROLOGICAL MONITORING

Meteorological sensors:

- ✓Air temperature
- ✓Relative humidity
- ✓Air pressure
- ✓Wind speed & direction
- ✓Precipitation
- ✓Insolation
- ✓Solar radiation
- ✓Soil temperature
- ✓Snow depth
- ✓Snow density

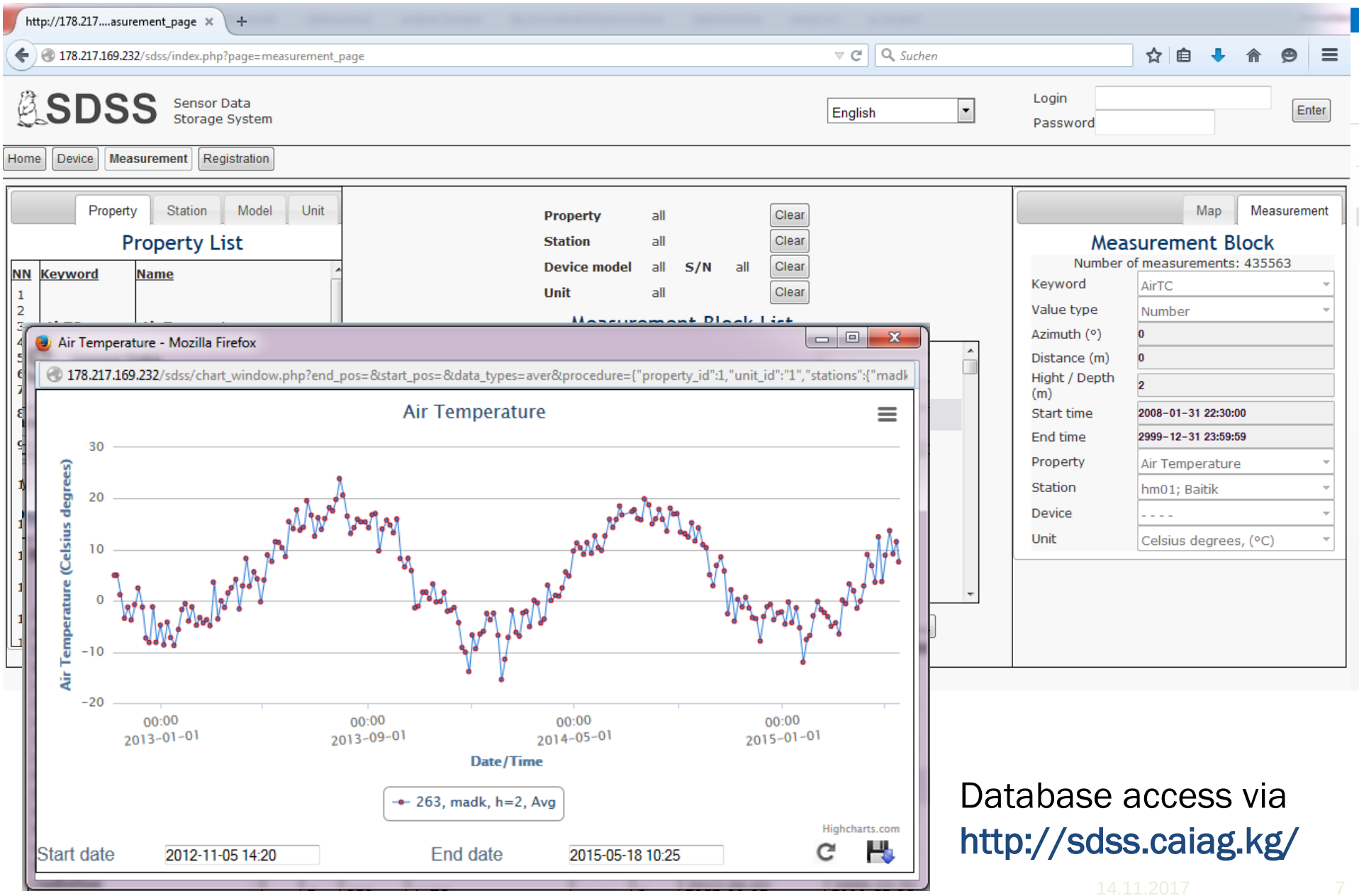






Schoene et al., 2013

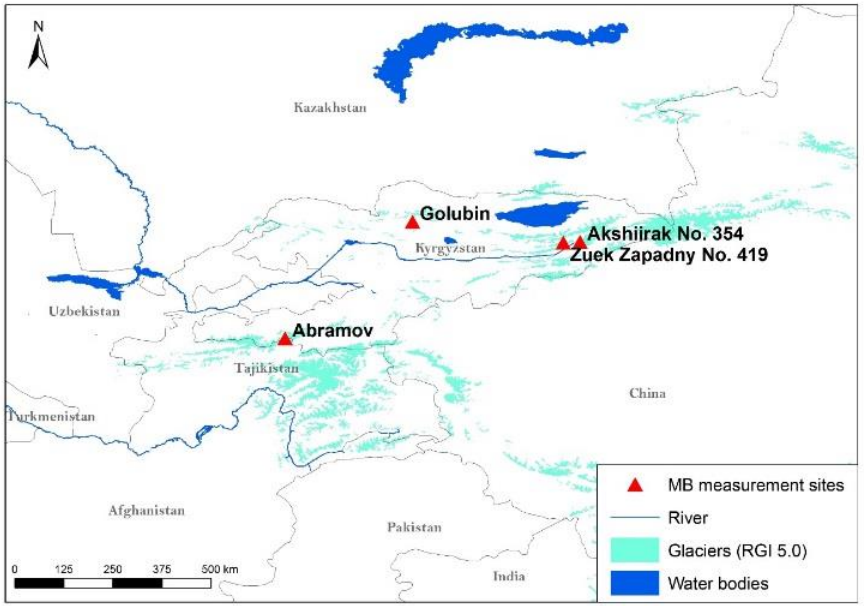
Station data

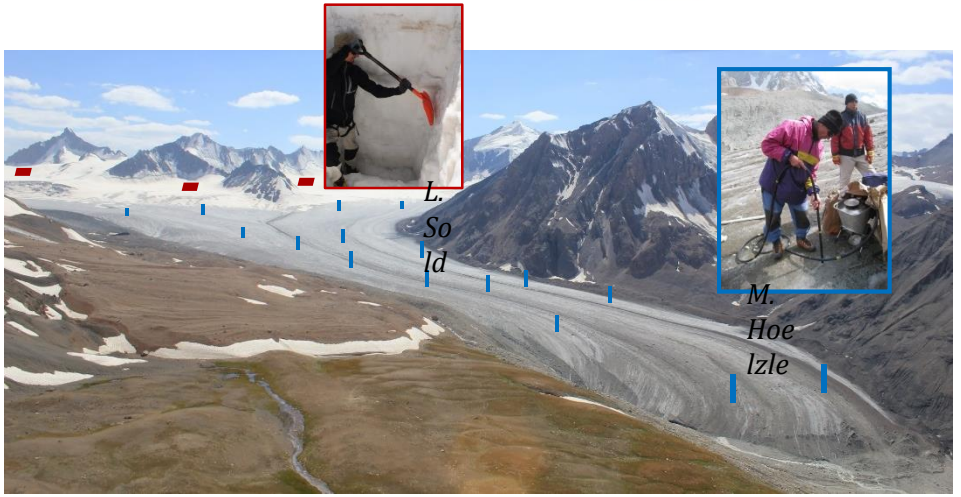


Database access via
http://sdss.caiag.kg/

Re-establishment of MB measurements

In cooperation with University of Fribourg and CAIAG



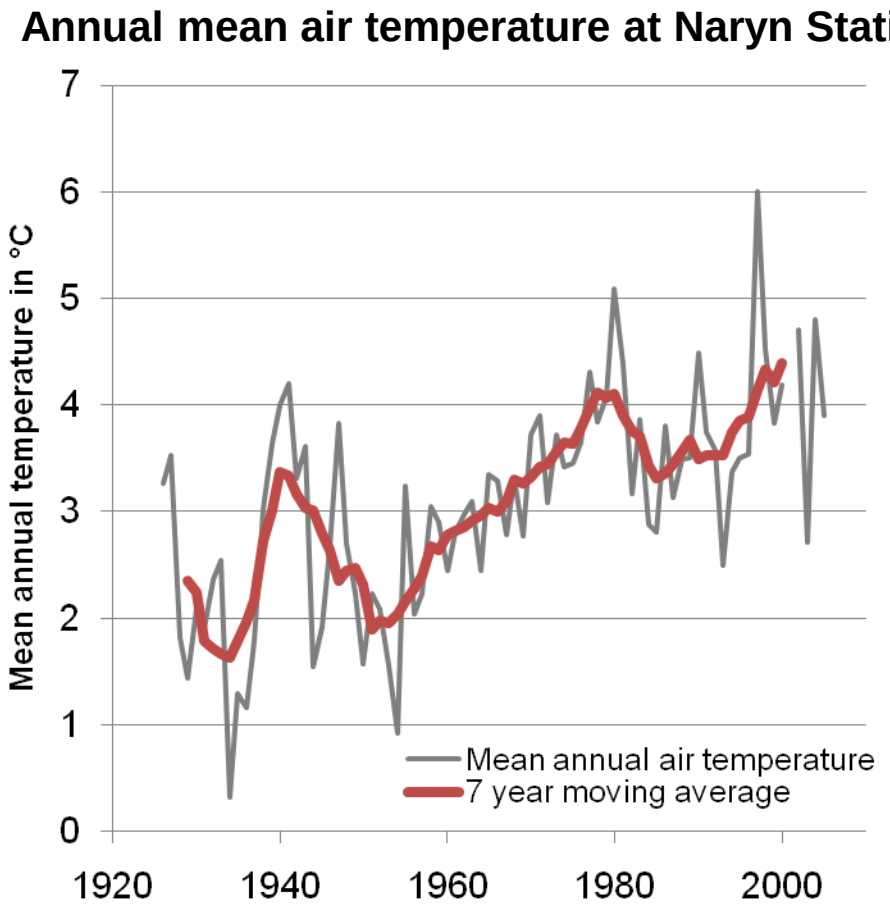


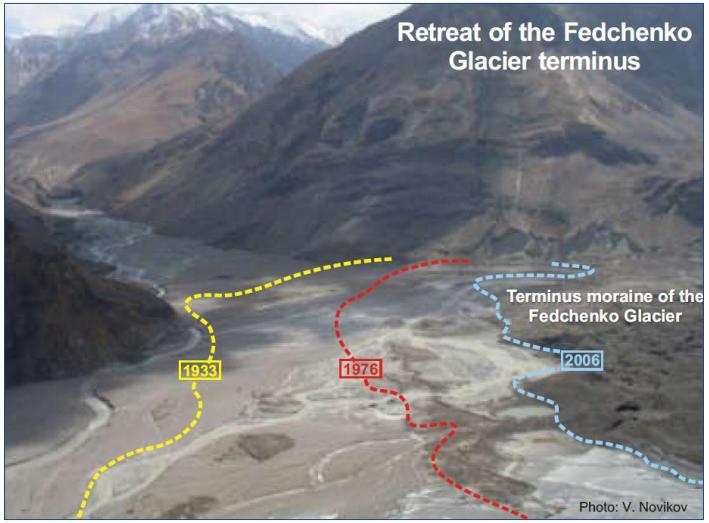
Hoelzle et al., 2017

CLIMATE IMPACT ASSESSMENT ON WATER RESOURCES AND GLACIERIZATION

A hotspot for climate change

Observed changes





From: UNFCCC, 2008

Precipitation?

Seasonal snow pack?

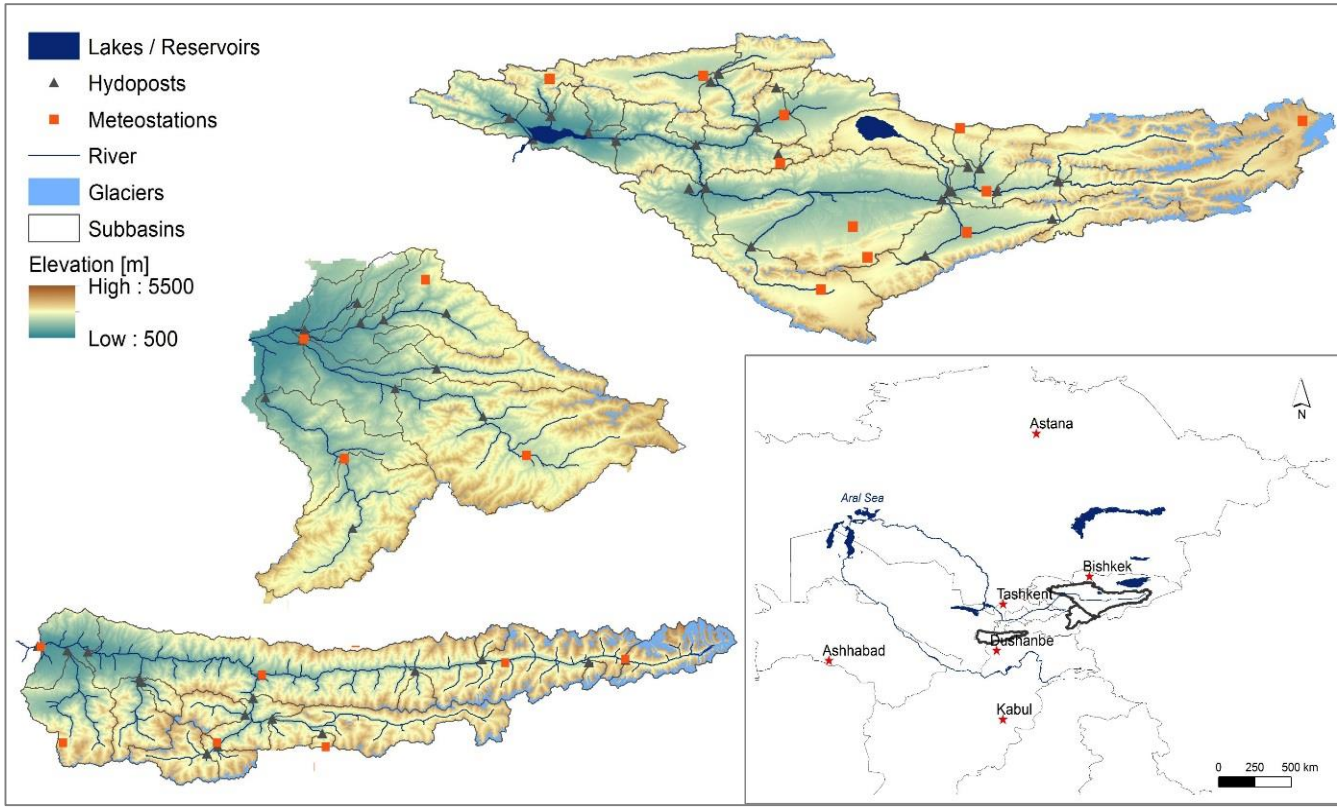
Glacier mass balances?

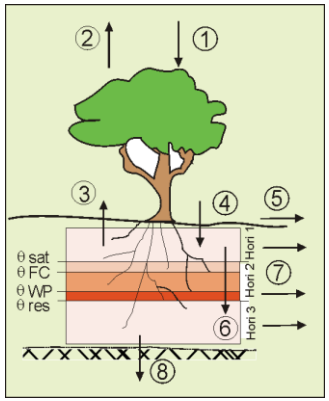
Spatial extent?

Extreme events?

CLIMATE IMPACT ASSESSMENT IN NARYN, KARADARYA AND ZERAFSHAN BASINS

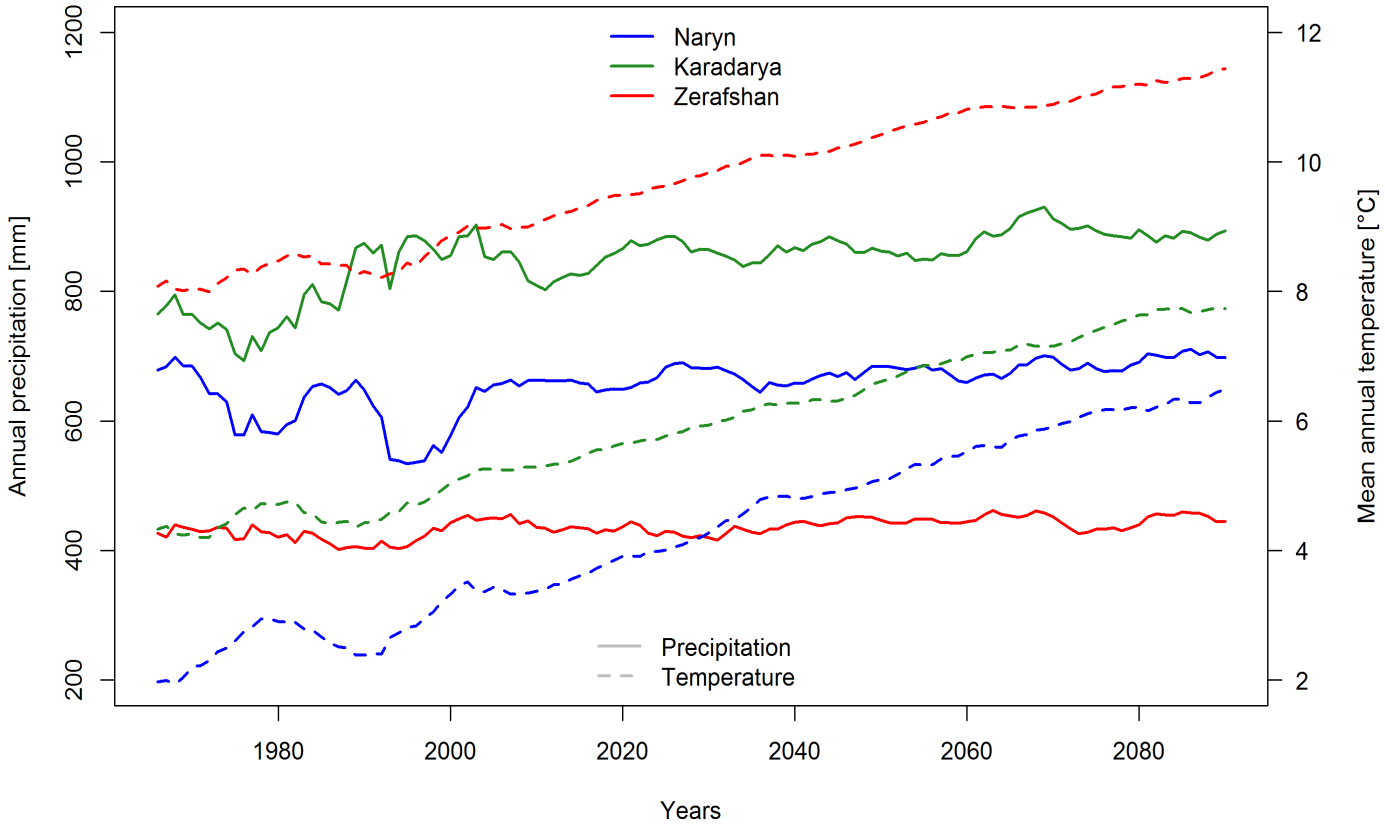
- Using semi-distributed hydrological model WASA
- Dynamical glacier evolution approach
- Multiobjective calibration using glacier MB, satellite SCA and discharge





- **Naryn basin (**Area ~ 52.000 km²)
- **Karadarya basin (**Area ~ 11.700 km²)
- **Zerafshan basin (**Area ~ 12.000 km²)

Temperature and precipitation changes based on IPCC CMIP5 scenarios

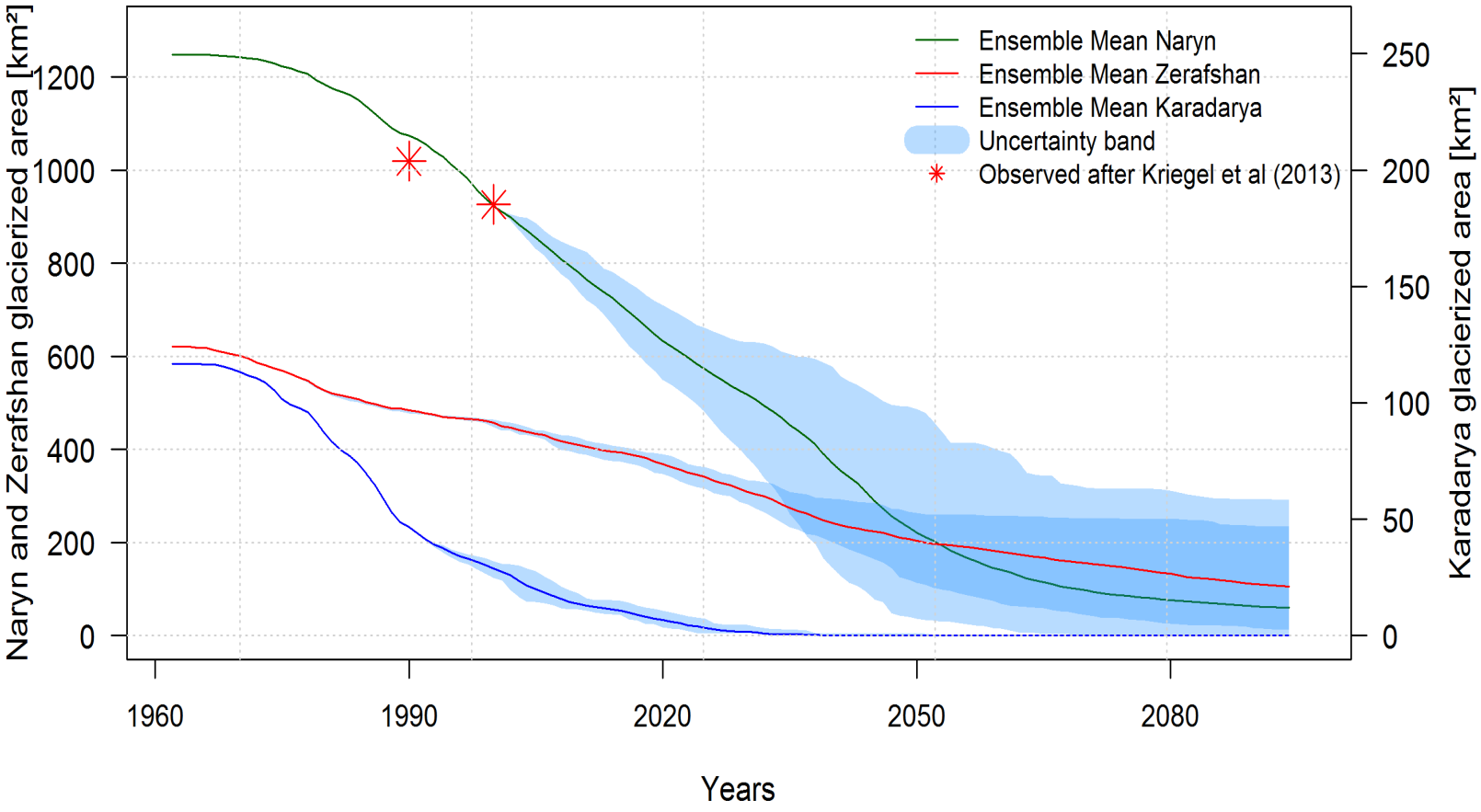


Bias corrected using station data

What is the impact on water availability?

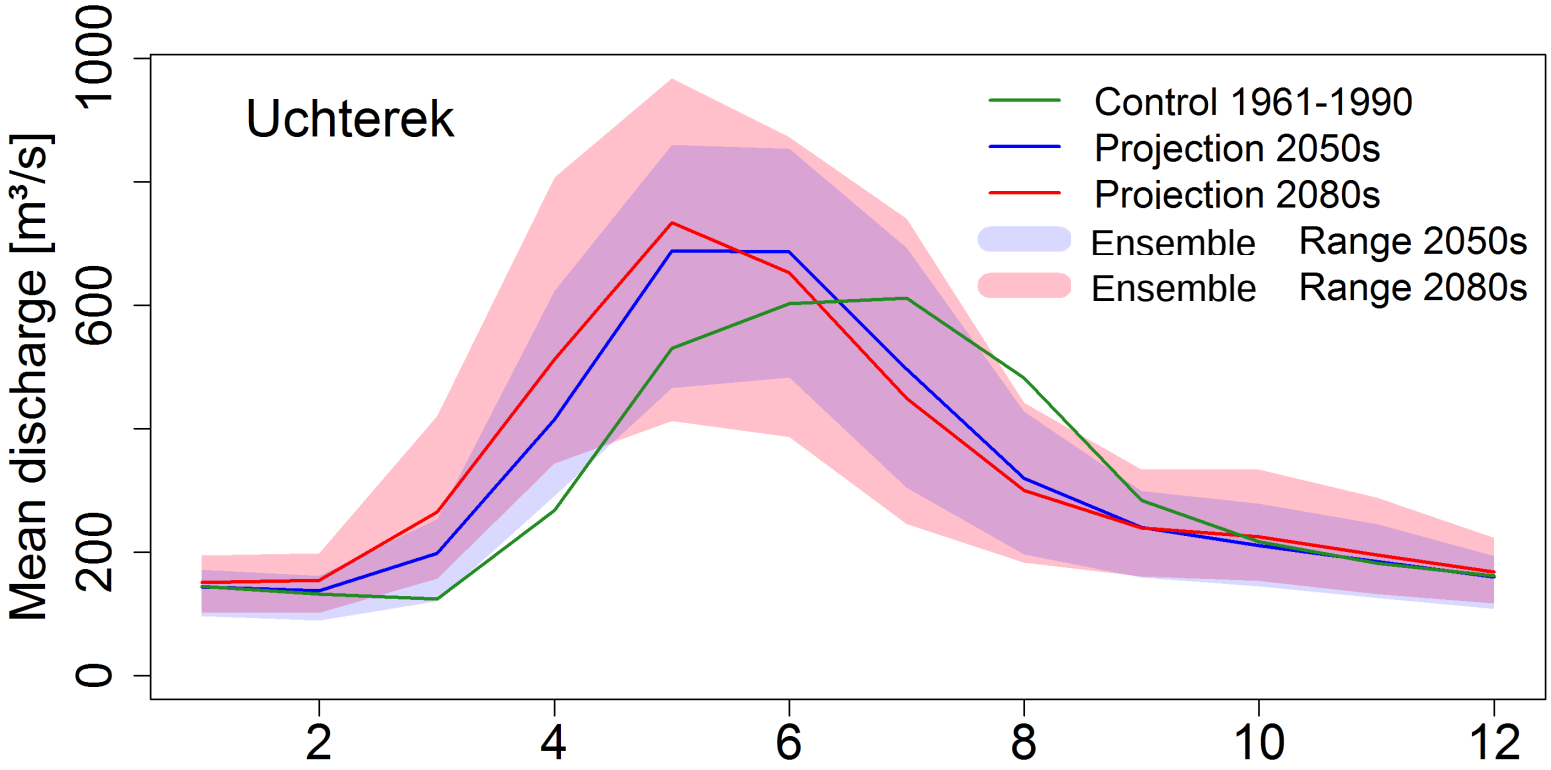
Gafurov et al., 2017, EGU-2017

Glacier decrease in Central Asia



Gafurov et al., 2017, EGU-2017

Interannual variation of water availability Naryn Basin



Gafurov et al., 2017, EGU-2017

SEASONAL RUNOFF FORECAST AND DROUGHT MONITORING

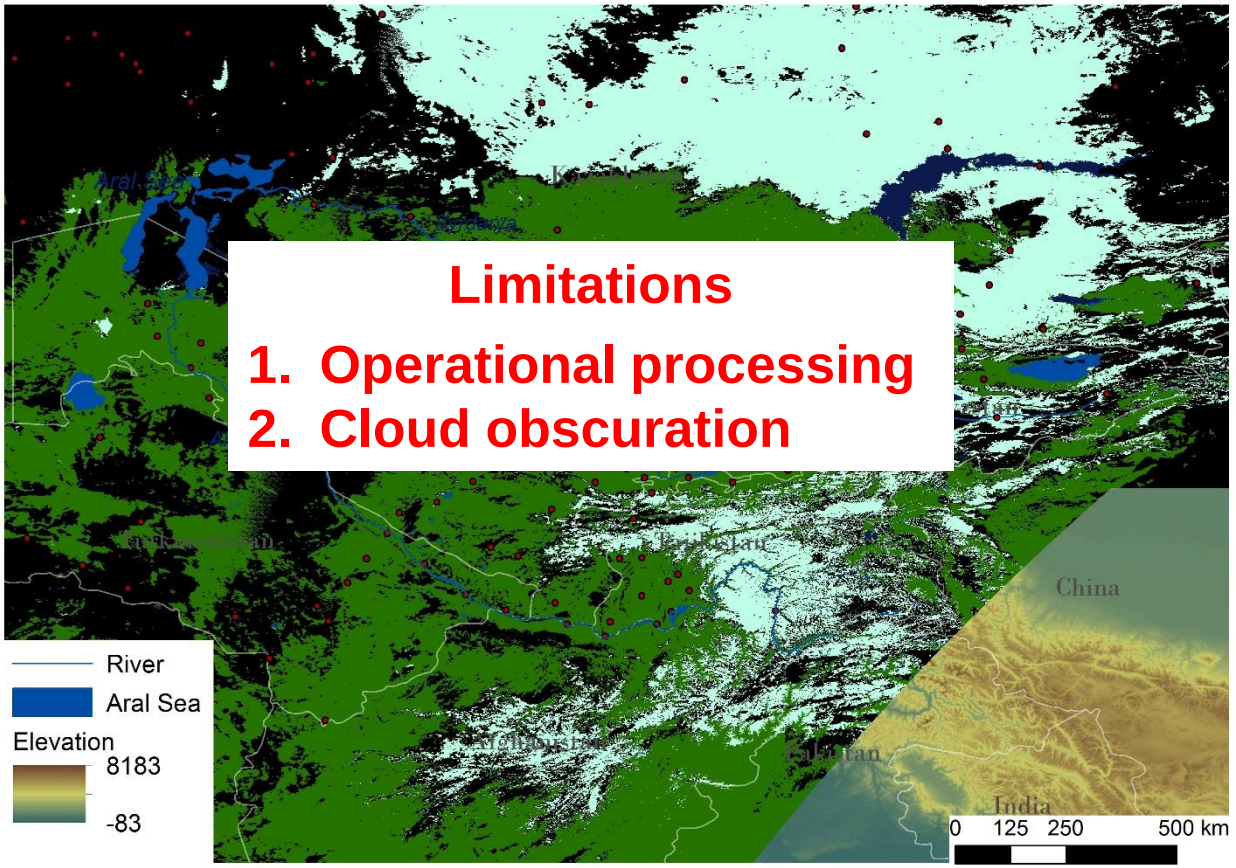
SNOWMELT MAIN SOURCE FOR SEASONAL DISCHARGE

Manual observation

- Observations mainly in low altitutes
- Point data – spatially less representative due to heterogeneity

RS observation

- Spatially distributed feature
- Continuous daily time series
- Observations also in remote areas
- Limitations due to cloud cover
- Freely available

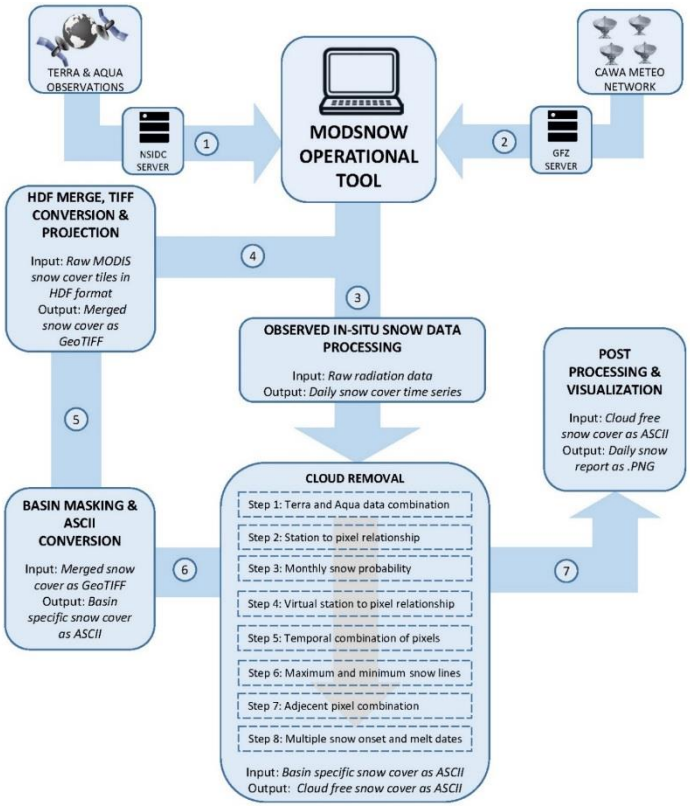


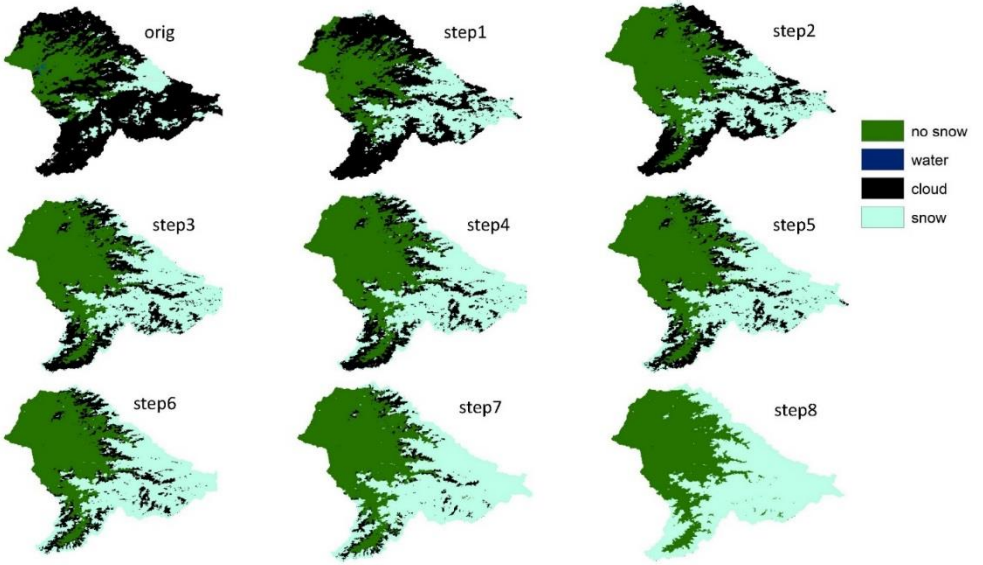
MODIS SC quality check in CA

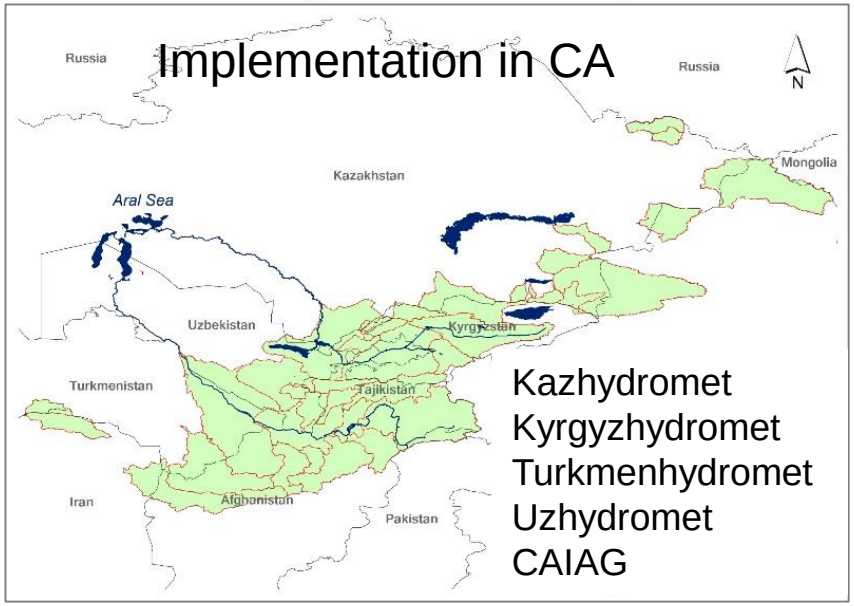
~ 93.1 %

Gafurov et al., 2013, Hydrol. Res.

MODSNOW OPERATIONAL TOOL



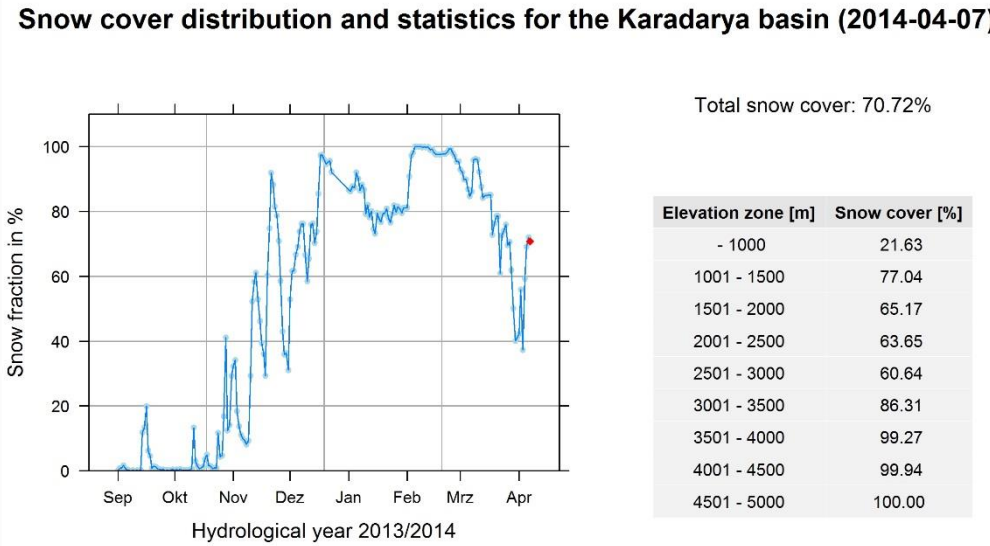


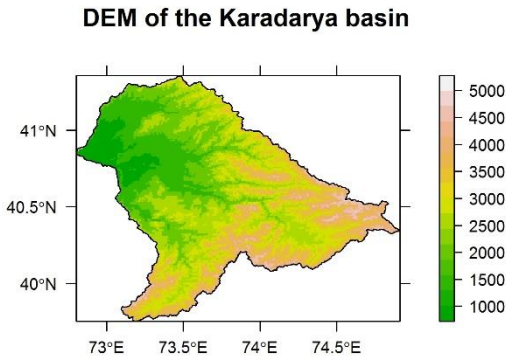


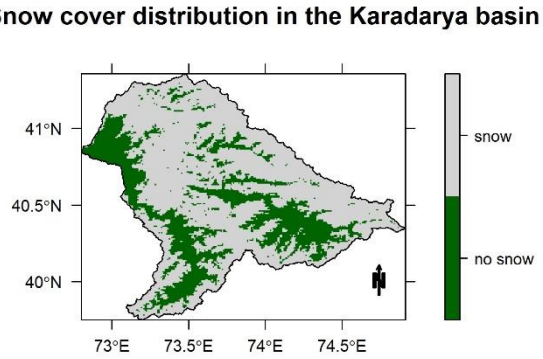
- Installed on a local computer as scheduled task
- Daily update of SCA data for pre-defined basins without user interaction
- Operational and non-operational mode
- Includes cloud elimination (even under continuous 100 % cloud cover)

Gafurov and Bárdossy, 2009, Gafurov et al. 2016

SNOW COVER MONITORING USING MODSNOW







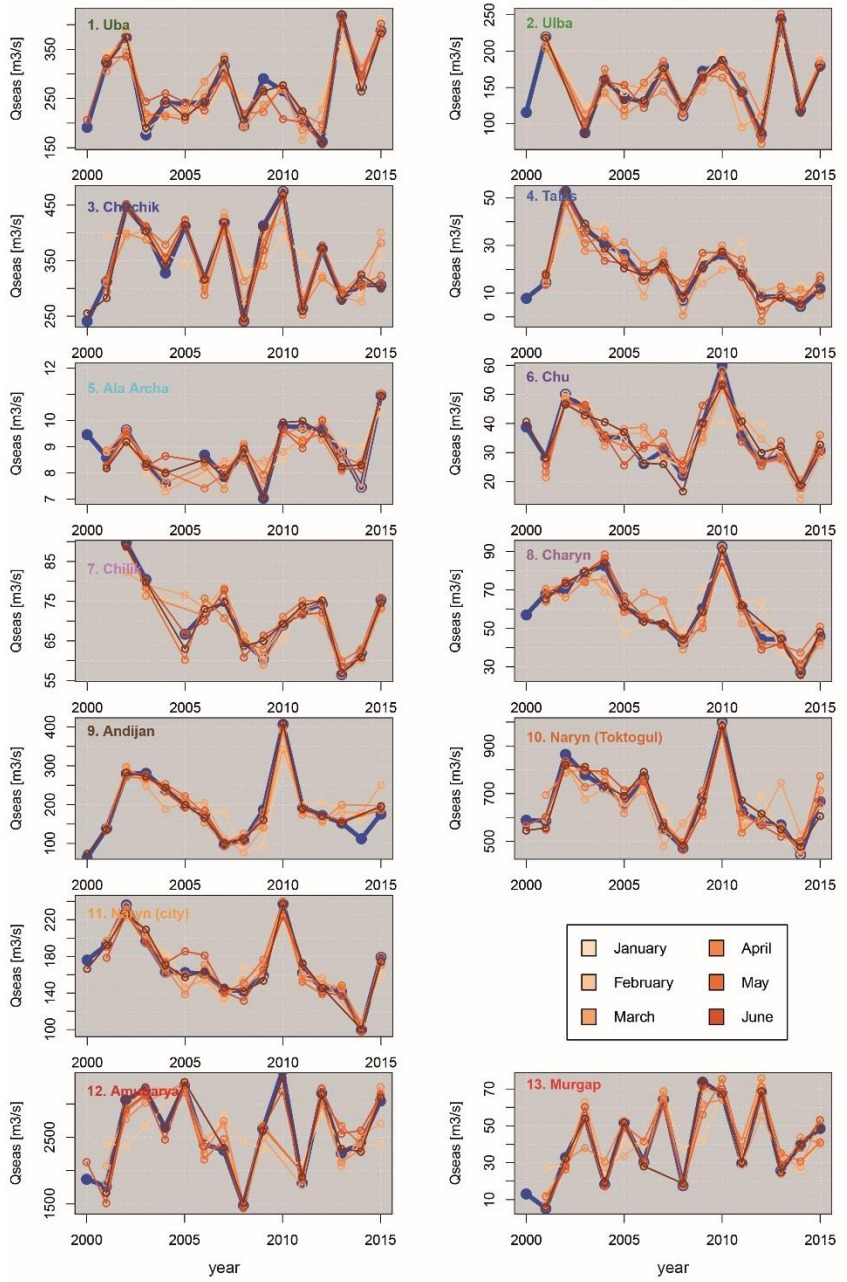
Melting snow is water resources to discharge

MODSNOW-Tool is freely available

Gafurov et al. 2016

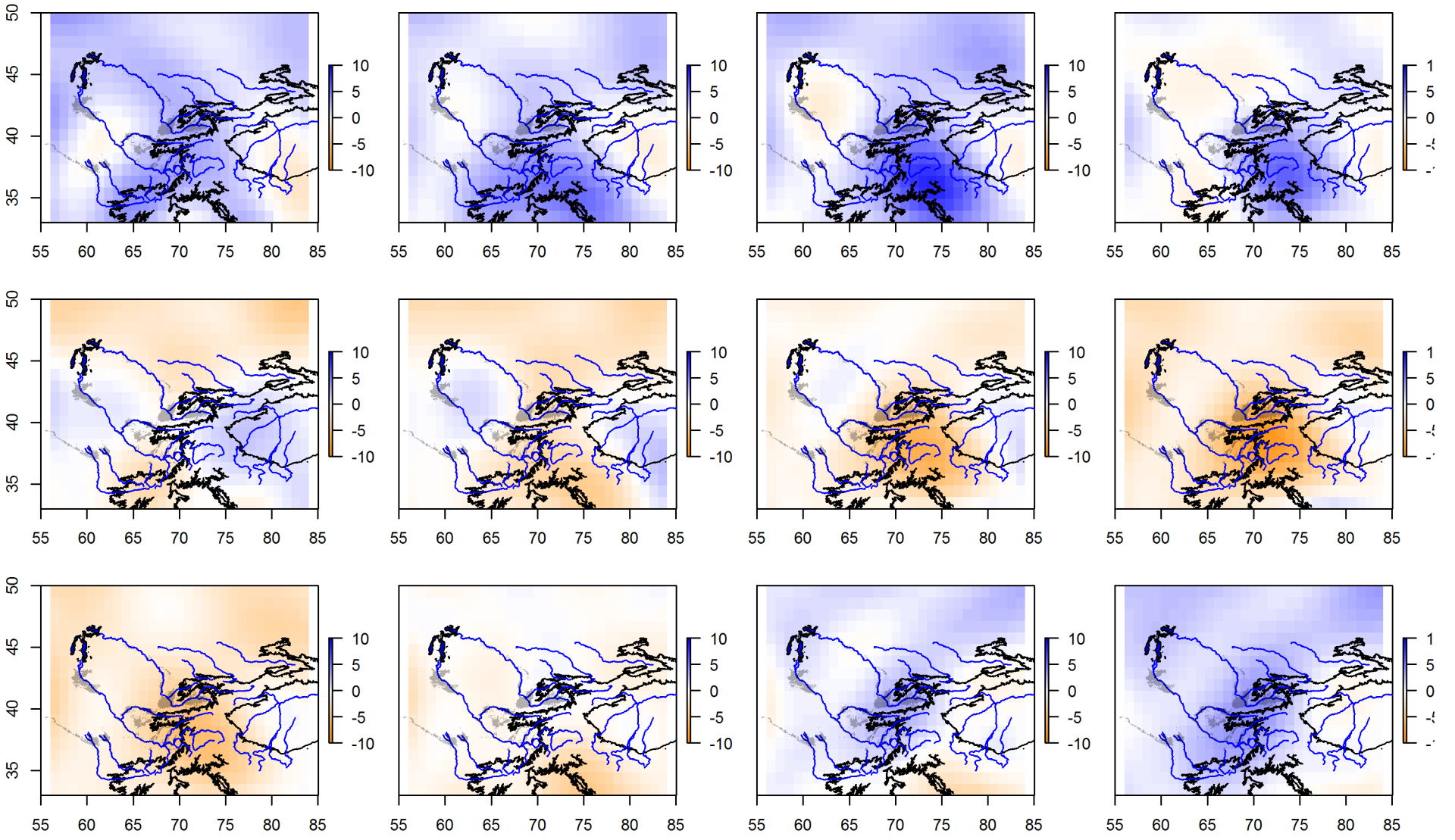
APPLICATION FOR SEASONAL FORECAST

- Forecast for 13 river basins
- Area range 239 km² to 288,000 km²
- Development of generic tool for deriving statistical forecast models driven by:
  - MODSNOW derived snow cover area (SCA)
  - Monthly observed precipitation
  - Monthly observed temperature
  - Antecedent discharge
- Output: mean seasonal discharge for April – September



Apel,.., Gafurov, 2017

Spatial distribution of water resources in CA (including GW) using GRACE data



Gafurov et al., in prep

CAPACITY BUILDING

Capacity Building

Trainings

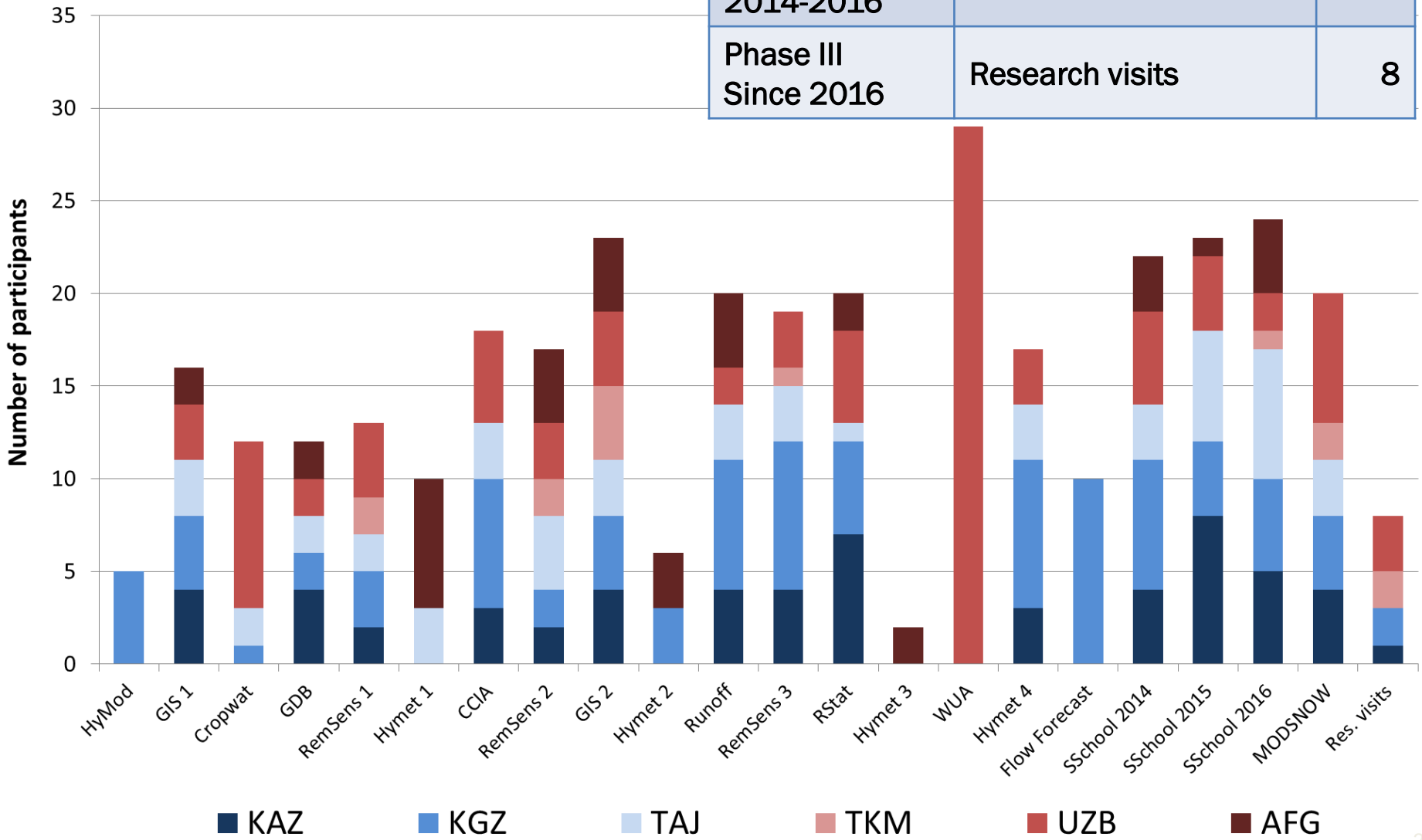
- Short-term vocational trainings for professionals in project specific technologies and methods
- Research stays at German partner institutions
- Annual Regional Summer School at the German-Kazakh University in Almaty
- Supervision of master and PhD theses

Operational tools

- MODSNOW
- WUEMoCA
- SDSS

Capacity Building

Phase I-II (III) 2009-2014	Vocational trainings	269
Phase II-III 2014-2016	Summer schools	69
Phase III Since 2016	Research visits	8



CAWA SCIENTIFIC CONFERENCE IN 2018

APPROXIMATE DATE: OCTOBER, NOVEMBER 2018

LOCATION: ALMATY

OFFICIAL ANNOUNCEMENT IN FEB 2018

EVERYONE IS WELCOME!

Contacts

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